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ABSTRACT

This issue, number 35 in the series, is divided into the sections of: (1) British science activities; and (2) Overseas and international science activities. Presented in a newsletter format, numerous topics of interest to science and mathematics educators pertaining to British education are presented. British science activities include: (1) Reports on Science in Society Project, The Mathematics in Education and Industry Projects and other science and mathematics projects; (2) Instructional suggestions for the teaching of biology, physics, statistics and mathematics; and (3) Publications of interest to teachers and educators that include a laboratory manual for schools and colleges, a review of research, teachers guides and other curriculum materials. The overseas section is devoted to news items from the countries of South Africa, Afghanistan, Sri Lanka, Jamaica, Guyana, Malaysia and Nigeria. International activities include reports on UNESCO projects, international conferences and international organizations. (HM)

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Science Education Newsletter

Issued by the
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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

SE 026 004

January 1978

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ACTIVITIES IN BRITAIN

1. SCIENCE IN SOCIETY: A NEW COURSE BEING DEVELOPED BY THE ASSOCIATION FOR SCIENCE EDUCATION (ASE)

(Condensed from an article of the same title by J L Lewis, appearing in the Times Educational Supplement of 3/6/77.)

Over the last fifteen years the philosophy and method of science teaching has been considerably changed by the Nuffield concepts. Admirable though this is, it in no way effects the traditional introvertism of science. This introvertism is difficult to justify in this age of the fast breeder reactor and Concord.

It is in an attempt to widen the knowledge of scientists to include the social implications of science that the ASE is currently developing a science-in-society course. This is intended to be a general studies course for sixth formers, and will have an A/O Level examination associated with it, initially administered by the Oxford and Cambridge Examination Board, with preliminary trials in September 1977.

The course will not replace any existing science courses; it will supplement them by showing the relevance of science in the world today.

The aims of the project are (1) to understand the nature and limitations of scientific knowledge, (2) to appreciate that the use of scientific knowledge can be both beneficial and detrimental to society and environment, (3) to appreciate that the earth's resources are finite, (4) to understand the need for, and to develop, the ability to make reasoned decisions which take account of all relevant constraints, (5) to recognise that moral considerations are involved in decision-making.

2. SCIENCE OF LIFE (STRATHCLYDE BIOLOGY GROUP)

This project started as a result of a consideration of some very practical aspects of the teaching of biology which involved analysis of the Scottish Certificate of Education syllabus and examinations, and a wide-spread disenchantment with the use of existing textbooks for this purpose. This led the members, of what was to become the Strathclyde Biology Group, to produce fundamentally new ideas of teaching biology to 14–16 year olds. The materials so produced were subjected to thorough shredding procedures and then revised. Feedback from the use of the course was provided by some 1500 pupils from 7 schools over a period of 5 years and led ultimately, to the production of national publications.

The Publications

These are produced jointly by Blackie and Son Limited and John Murray (publishers) Limited. They are a series of student units, **Unit 1**, Maintaining the Species (£0.75), **Unit 2**, Energy and Life (£0.70), **Unit 3**, Exchanging Materials (£0.70), **Unit 4**, Movement and Control (£0.75), **Unit 5**, Interactions (£0.70). In addition to the student units, there is a great deal of assistance to the teacher provided by background information teaching notes and references which appear in the Teachers' Resource Book (£4.95), equipment and lists and preparation details in the Technicians Manual (£1.95), and the Experimental Guide (£1.10) which eliminates the necessity for issuing time-consuming instructions.

Aims of the Course

The writing and subsequent revisions have been carried out in the context of the following aims.

a. Examination success. The course is now geared very much to the requirements of the GCE and CSE Examinations.

b. Comprehension of basic life processes.

c. Respect for life.

d. An appreciation for man in his surroundings and his effect on it.

e. An elementary appreciation of the organisation and inter-relations of life processes.

f. Stimulation and expansion of interest in biological topics in general.

g. An awareness of, and experience in, scientific procedures.

h. Exposure to the experimental approach and the solution of problems.

i. An awareness of some modern techniques.

k. Training in the use of second-hand data.

l. An awareness of inherent inaccuracy and design faults.

The total course has been shown to carry out the idea that a structured course, far from being incompatable with discovery based approaches, can be used to encourage this style of learning. However, it is not necessary to use the course in this way: the structure in no sense dictates a teaching method. What it does, is to free the teacher from many organisational problems, leaving them better to deal with individual pupils or groups who are experiencing difficulties, or to challenge those of higher ability. The course as a whole will be of interest to three main groups of teachers: (1) those who are enthusiastic about group work as compared with teacher centred work; (2) those who are enthusiastic about discovery methods but have found the results to be too haphazard; (3) less experienced teachers, or specialists in science other than biology, who nevertheless, are teaching the subject.

3. LONDON INTERNATIONAL YOUTH SCIENCE FORTNIGHT 26 July – 9 August 1978

The London International Youth Science Fortnight was held for the first time in 1959 with HRH Prince Philip, Duke of Edinburgh as founder Patron. Since then it has taken place in London each year at the end of July and the beginning of August. In 1978 the Twentieth Science Fortnight will be held from 26 July to 9 August.

The aim of the Science Fortnight, organised by the Council for International Contact, is to give a deeper insight into science and its applications for the benefit of mankind and to develop greater understanding between young people of all nations. The academic level of the Science Fortnight is that of university entrance and it is open to science students aged 16–22 year from all countries of the world. The programme will include lectures and demonstrations by outstanding scientists, seminars and discussions on current developments in science, visits to research establishments, university departments and industrial plant, sightseeing and social activities.

The cost of participation is about £140; this covers all London expenses except pocket money. The conference is fully residential and the language used throughout is English.

Fuller details can be obtained from:

The Council for International Contact,
PO Box 818,
179–183 Fulham Palace Road,
London W6 8QU.

4. THE TEACHING OF MATHEMATICS IN MIXED ABILITY CLASSES

There has been a marked trend recently to abandon 'setting' or 'streaming' in the early secondary school years in Britain. The resultant system of organisation is referred to as 'mixed ability'. The teaching of mathematics within this form of organisation remains, however, a controversial issue. A recent document 'An appraisal of problems in some key subjects by HM Inspectorate' mentions that in some cases problems have been accentuated by the decision to adopt mixed ability teaching for mathematics.

The mathematics committee of the Schools Council has been aware that the problems of teaching mathematics in a mixed ability class are sufficiently distinctive to merit special study. With this in mind they set up a working group in April 1976 to carry out a one year survey of current practice and to produce a report.

To introduce the results of its work, the Working Party held a residential weekend conference in Birmingham in September 1977, attended by mathematics advisers, curriculum development officers, heads and teachers concerned in an advisory role in their own areas and schools.

The Group included classroom teachers, advisers and lecturers. Initially a questionnaire was sent to local education authorities asking for details of schools which were using mixed ability teaching in mathematics in the age range 11 to 16, persons with experience in this field and any active local groups producing materials for mixed ability classes.

The group identified a range of schools which represented a fair cross section of current practice. These schools were contacted and visits arranged. Persons with experience and active local groups were invited to make written submissions to the group.

During visits to schools various aspects of teaching mixed ability classes were explored by talking to teachers and children, or by observing what happens in the classroom. Particular areas of interest were: departmental philosophy; organisation; teaching models; course content; materials used; assessment and evaluation. Some schools which had special problems or features were revisited. These revisits included a further investigation of a variety of schemes, methods and materials, and also included schools with a high immigrant population (and hence language difficulties), float teachers for remedial work and assessment team teaching, mixed ability up to 16, CSE mode 3 examinations, a degree of pupil choice built into the scheme, schemes using a variety of teaching models, a strong emphasis on investigation type work, a strong emphasis on 'traditional' course content and a gradual introduction of mixed ability teaching.

Some predominant teaching models became apparent. These models tend to overlap within schools since a variety may be used with different classes and, in some cases, a combination of models may be used with an individual class. Whole class activity involves all the pupils in the study of the same topic at the same time. The pupils may either be working from material in the form of worksheets, workcards or topic workbooks, or be involved in various levels of investigation of a teacher-initiated problem or activity. Group work involves small groups within the class carrying out different tasks from a variety of either commercially published or school produced sources. The most popular teaching model is some form of individualised work. Pupils may work on materials from a structured scheme where the tasks are assigned systematically or by the teacher, or they may choose their tasks from a bank of material with guidance from the teacher.

The Working Group's report is being published in late 1977. It will deal with the theoretical background to the development of mixed ability grouping and considers what influence this kind of organisation may have in achieving some of the basic aims of mathematical teaching and learning. It summarises the Group's findings and recommendations and, through case studies and detailed descriptions of teaching models and materials, examines the current state of mathematics teaching in schools where mixed ability grouping has been adopted.

The report will clearly be of most practical use to mathematics teachers, whether specialists or not, but its consideration of issues such as differentiation between pupils, classroom organisation, planning and co-operation, discussion in the classroom and assessment, will be of interest to many others.

Mixed Ability Teaching in Mathematics is published for the Schools Council by Evans/Methuen Educational. Orders (including standing orders) should be placed with usual suppliers or bookshops. In case of difficulty, contact the Sales Department, Evans/Methuen Educational, North Way, Andover, Hants, SP10 5BE.

210 x 148 mm 148 pp ISBN 0-423-89940-6 Price: £2.50 net

Publication date: late 1977.

A list of some of the schemes of work widely used in mixed ability teaching of mathematics in British secondary schools follows, together with information that has not previously appeared in SEN.

1. **Development of Ideas in Mathematical Education (DIME) Projects**

Department of Education, University of Stirling, Scotland (see SEN 32.13).

2. **Hertfordshire Computer Managed Mathematics Project (HCMMP)**

The Advisory Unit for Computer Based Education, 19 St Albans Road, Hatfield, Hertfordshire.

HCMMP is an all-ability worksheet-based course for 11-13 year old pupils. The three components of the course are available separately and consist of:

- 25 modules of work, each usually consisting of 12 worksheets, a Studysheet and ancillary material. Each module is divided into 4 or 5 levels of difficulty (A–E). All children begin at A level and work through the levels. Each level of difficulty is sub-divided into 3 worksheets: 'M', 'T' and 'X'. The 'M' and 'X' sheets are submitted on marked-sensed documents or cards and are marked by computer. The 'X' sheet is designed for extra practice and pupils are assigned to it according to their performance on the 'M' sheet. The 'T' sheet is teacher marked and allows for more flexible activities.
- 24 video-taped programmes, each about 15–20 minutes long, used to introduce a module.
- computer software to mark pupils' work, schedule pupils on to fresh work and to provide teacher registers and analyses for pupil performance.

Further details are available from the Director at the above address.

3. **Kent Mathematics Project** (KMP), Teachers' Centre, 6 Culverden Park Road, Tunbridge Wells, Kent

The objectives of KMP are:–

a. To provide a unique course in Mathematics for each individual child, using material suitable for all abilities of children between 9 and 16 years and tailored to pupils' weaknesses and special interests.

b. To provide teachers with a flexible system within which they can, if they desire, introduce their own interests and skills.

c. To give the teacher opportunities to use his or her skills at diagnosing weaknesses, helping children to develop concepts and establishing co-operative rather than teacher-dominated relationships.

d. To provide a system in which children will accept responsibility for most of their own learning, not working in isolation but with social interaction with other children.

e. To offer an assessment of each pupil's mathematical ability at any stage in his or her learning career, culminating in Mode 3 CSE or O-level assessments.

The individualised course consists of an entry requirements list; a diagnostic test to be taken on entry; a bank of course material consisting of worksheets, booklets and tapes; a short test for each task; a hierarchical flowchart for the tasks; matrix cards; record cards; teacher's notes; text answers.

4. **Leapfrogs**

The Leapfrogs Group is an association of teachers using and developing a range of materials as additional resources for mathematics teaching. Printed books are under the general title of Networks, and are published by Hutchinson for Leapfrogs. The books in the series are conceived for use with mixed ability classes of ten to fourteen year old pupils and are designed to provide ideas and activities to stimulate the learner's involvement in mathematics.

Three kinds of books are available:–

Action books – booklets on particular themes which invite the reader to explore the consequences of specific actions. Titles include **Animations, Codes, Bands, Doodles, Moves, Folds, Chance, Pegboards, Orders, Cubes, Tiles** and **Prints.**

Links – anthologies of pictures and diagrams to stimulate a variety of possible mathematical reactions. **Links, Leads** and **Leaves** are available.

With Few Words–work books which introduce some basic mathematical ideas through puzzles, diagrams and drawings. **Blue Book, Orange Book** and **Green Book** are available.

Other material has been produced by the Group. This includes a cassette tape recording, 8 mm films, large posters and packs of slides. Further details may be obtained from – Leapfrogs, 6 King Edgar Close, Ely, Cambridgeshire, CB6 10P.

5. **Mathematics for the Majority Continuation Project** (see SEN 24.8, 25.8, 28.6)

6. **Modular Mathematics** (see SEN 24.11.2)

The Modular Mathematics Organisation has issued the first of an occasional series of bulletins written by and for teachers who are using the material. It is published, as is the Modular Mathematics material itself, by Heinemann Educational Books, 48 Charles Street, London W1X 8AH.

7. **Mathematics Project, Resources for Learning Development Unit** (RFLDU), Redcross Street, Bristol, BS2 OBA (see SEN 30.1)

Full details, and a catalogue of available material, is available from this address.

8. **School Mathematics Project, Cards I and II**, Cambridge University Press (see SEN 23.13)

9. **Secondary Mathematics Individualised Learning Experiment** (SMILE)

Developed by the Inner London Education Authority at Ladbroke Mathematics Centre, Middle Row School, Kensal Road, London W10 5DB.

SMILE is an individualised learning situation developed from the Kent Mathematics Project (see above) for use with mixed ability classes. It aims to provide a learning situation suited to each pupil's ability and experience with an emphasis on the pupil's learning rather than the teacher's teaching. It incorporates the following resources:

a. Task cards and commercial material, hierarchically structured.

b. Answer books and test books.

c. Equipment needed for a particular task.

d. The teacher.

Material is written by the teachers and regular meetings are held to discuss progress at Ladbroke Mathematics Centre.

10. **South Nottinghamshire Project**

This project accepts the principle of the whole class working in the same general field but with differentiation of the particular problems attempted by individuals. This contrasts with individualised, independent learning schemes as a strategy for teaching mixed ability classes.

Two essential arguments concerning the mathematical education of 11–12 year old pupils are incorporated into the scheme. Firstly that pupils should investigate mathematics for themselves leading to the drawing of conclusions, the making of generalisations and the giving of explanations and proofs. Secondly that simple apparatus provides the best means of entry into mathematical activity at this age.

The material is a deliberate attempt to provide situations to which every pupil can respond at some level or other which is valid for him. The content is based on 15 topics, each of two and a half weeks duration. Topics include Statistics, Whole Number Relationships, Shape, Symmetry, Angle, Binary Numbers, Sequences and Functions, Decimals, Tessellations, Functions and Graphs, Functions and Ratio, Area and Topology. For each topic there are background notes, a general survey of possible content, workcards and a teacher's commentary. The teacher's commentary contains details of materials needed, the main content and process objectives, a description of the significance of the topic, lesson introductions and suggestions for helping the least able and extensions for the more able.

Each topic begins with a situation discussed by the teacher with the class, then the investigation is continued by the pupils. The teacher gives extension questions to different groups of pupils as and when they are ready, either orally or on cards.

The Project stresses the need to avoid swamping the teacher with low level work: marking, testing, organising workcards, but instead to free him or her for the important tasks: initiating work, stimulating discussions and intervening to suggest new problems. It aims to provide flexibility, providing sufficient guidance for beginners and non-specialist teachers, without demanding a rigid or whole-hearted commitment to the materials.

The material is to be published during 1978, under the title 'Journey into Maths', by Blackie and Son Ltd, Bishopbriggs, Glasgow G64 2NZ. The first year materials, to be published in January, consists of the following items:

- Five packs each comprising 16 to 32 spirit masters. Each of three of these contains most of a term's work, the units into which they are divided being:

  Pack 1: Statistics, Shape, Binary numbers, Symmetry, Sequences and functions.

  Pack 2: Metric measurements, Co-ordinates, Open investigations (A), Tessellations, Linear functions.

  Pack 3: Geoboard areas, Ratio numbers, Angle, Open investigations (B).

  Pack 4: contains copies of a diagnostic test of number skills, some puzzles, and the answers to the exercises in the Number Skills booklet.

  Pack 5: contains spirit masters for the more frequently used grids.

- A 32-page Number Skills booklet. This is regarded as a particularly important part of the course. There is invariably a wide spread in the proficiency with which pupils deploy basic number facts and the four rules. To develop and maintain these skills requires regular practise, and this is provided in the Number Skills booklet in a form which allows for repetition with graded variation at levels suitable for each individual pupil.

- A comprehensive Teacher's Guide, which contains reproductions of all the spirit master worksheets, together with commentaries, lists of requirements and – particularly valuable – annotated examples of the work of pupils who have used the course.

The second year materials will follow a broadly similar pattern, and will be published in May 1978.

Further information about the Project may be obtained from Dr A W Bell, Shell Centre for Mathematical Education, The University, Nottingham.

11. **The Structured Mathematics Scheme**, Structured Mathematics Centre, Reaside School, Rea Street South, Birmingham B5 6LB (see SEN 30.8)

5. NATIONAL MATHEMATICAL CONTEST, 1978

The British National Mathematical Contest (NMC) will take place on 14 March 1978. It is organised by a joint committee of the Mathematical Association and the School Mathematics Project.

The Contest uses the American High School Contest Paper. The subject matter is limited to material from elementary algebra, simple plane coordinate geometry, intermediate algebra and trigonometry. Most of the candidates are 6th formers, but bright 4th and 5th formers can do well on the paper.

The names of the high scorers in the NMC are printed annually in the September issue of 'Mathematics in School', a journal of the Mathematical Association. Copies of the 1976 and 1977 papers are available from the Mathematical Association, 259 London Road, Leicester LE2 3BE, at 7p per paper and a stamped addressed envelope.

High scorers in the NMC are invited to take part in the British Mathematical Olympiad (BMO), which takes place in late March, shortly after the NMC.

The BMO paper is similar in style to the papers set in the International Mathematical Olympiad (IMO). Certain BMO candidates are invited to take a Further International Selection Test (FIST) and the British team in the annual IMO are selected from among these candidates.

6. PROJECT IN STATISTICAL EDUCATION (SEN 30.9)

The project has so far produced 24 trial units, each of which takes about 4/5 hours. Eight more units are planned. There are 55 trial schools, and a further 80 associated schools which also receive trial materials.

Each unit starts with a specific problem and develops statistical techniques necessary to help solve the problem. The second batch of 12 are listed below. The meaning of the coding is:

1/2/3/4	For 11/12/13/14 year-old pupils
M/H/SC/SO/O	For a subject area of mathematics/humanities/science/social science/other
1/2 etc	Are consecutive units in the same category
	Thus 30.2 is the second unit in the other category for third year pupils
1SC.1	Statistics Rules – o.k.?
1M.3	Simple Simulations
1SO.2	The Leisured Class
2SC.1	Seeing is Believing . . . . . or is it?
2M.1	Fairground Follies
2SO.1	Opinion Matters
3H.1	Multiplying People
3SO.3	Equal Pay
30.3	Phony Figures
4SO.2	Counting Citizens
4M.2	Testing Testing
4SO.3	Retail Price Index

As examples of the themes of the units, Equal Pay discusses wage rates of men and women, using cumulative percentage curves. The median gives the central tendency while the spread is measured using the inter-quartile range. Comparison problems such as tax and the self-employed are raised. Testing Testing contains ideas of conditional probability applied to a number of diverse situations, including the breathalyser, radiography, fuses and criminal judgements. Phony Figures deals with abuses of statistics, which is almost a fine art especially in advertising. A few of the more common abuses are exposed to enable people to look at statistical data carefully and critically.

The Project held two weekend writing conferences in Sheffield in September 1977. A one-day national conference will be held at Sheffield on 1st April 1978. This open conference will explore statistical education for the age range 11–16. The work of the project in this area will be described as well as plans for the future. There will be working groups on the role of statistics in different subjects and how it can best be integrated into the school curriculum. There will be opportunity to see the project's trial material and other documents, and it is hoped that there will be an exhibition of books and visual aids for the teaching of statistics, as well as invited speakers to talk about statistical education.

Further information about this national conference, and any other aspect of project, may be obtained from the Director, Schools Council Project on Statistical Education, Department of Probability and Statistics, The University, Sheffield, S10 2TN.

7. ELECTRONIC CALCULATORS FOR USE IN SECONDARY SCHOOLS

A joint working party comprising representatives of the Association for Science Education, the Association of Teachers of Mathematics and the Mathematical Association has recently produced the following set of recommendations for essential and desirable features in electronic calculators for use by the 11–16 year range of pupils in secondary schools. The recommendations are a consensus of opinion of those representing mathematics education and those considering the problem from the viewpoint of the science teacher. Features printed in **bold** typeface are considered to be essential on any electronic calculator for use by secondary school pupils. Those marked with an asterisk are thought to be highly desirable, while the remaining features are considered desirable but not essential.

Keyboard
Positive action, single function keys, **well spaced and appropriately colour coded.** It is desirable that the case and keys should be resistant to attack from common solvents and the keyboard 'splashproof'.

Display
An eight position display is sufficient. It should not be too small and should be set at an appropriate angle thus allowing it to be readable, when placed on a desk, by both a sitting pupil and another person standing.

Notation
Fully floating decimal point to eight digits.
*User entry into exponent notation. The machine should convert to exponent notation (standard form) when the number becomes too large or too small to be accommodated by the display in the usual form.

Power Supply
Rechargeable batteries are particularly useful and economic for class sets. **Any charger used must be to BSI standards and approved by the calculator manufacturer.**

The disadvantage of disposable batteries is the high cost of replacements which can prove expensive over a period though the initial cost of the calculator may be cheaper. This may be acceptable for private use, especially if the calculator is fitted with an automatic switch off.

*An indication of the point at which reliable operation becomes doubtful due to low battery voltage.

Accuracy
*Automatic round-off on all four basic functions. **Non-significant zeros to be suppressed.**

Functions
Four basic functions.
Clear and clear last entry (preferably on separate keys).
Percentage.
Change sign or means of entering negative numbers.
Square root.
Reciprocal.
Trigonometric functions and their inverses capable of working in degrees.
Pi. (π)
Powers (y^x)
Squares.
Brackets.

Logic
Algebraic.
*All single operator functions to work on number currently shown in display and not to complete any pending operations.

Memory
Fully addressable memory to include M+, M–, CM and RM.
A second memory is useful especially if no constant is available.

Constant
A switchable constant facility operating correctly on all four functions is desirable.

General
Good instruction book.
Guarantee.
Speedy repair service (note that it is frequently uneconomic to have repairs done outside the warranty period).
*Non-slip feet.
The calculator and charger should be robust and 'droppable'.

THE NATIONAL DEVELOPMENT PROGRAMME IN COMPUTER ASSISTED LEARNING

(See SEN 29.15, 29.16.3 and SEN 30.12)

This five year programme has been responsible for the initiation and administration of over 30 projects in educational and training institutions throughout the United Kingdom. The National Programme completes its work on 31 December 1977 – though the work started and supported by the programme will continue!

The **aims** of the National Programme have been:–

to develop and secure the assimilation of computer assisted and computer managed learning on a regular institutional basis at a reasonable cost;

to make recommendations to appropriate agencies in the public and private sectors concerning possible future levels and types of investment in computer assisted and computer managed learning in education and training.

The programme has supported some 30 projects in five main areas of activity:–

in tertiary education the programme has concentrated on mathematics and statistics, science, engineering and medicine;

in primary and secondary education;

for training in the Armed Services;

for management and technician training in industry;

finally, a small number of projects have been designed to gain experience in the transfer of programmes and learning packages.

Following the winding up of the National Programme information of a general nature will be available from the Information Officer, Council for Educational Technology, 3 Devonshire Street, London W1N 2BA.

A comprehensive summary of the projects and programmes supported by the National Programme is available under the title Project Summaries and Programme Index. This is available from the Council for Educational Technology at a cost of £3.00 (UK).

The NOPCAL final report is also available from the Council for Educational Technology at a cost of £5.50 (UK).

Some case studies have been prepared and described in a publication – Computer Assisted Learning in the United Kingdom by Richard Hooper and Ingrid Toy. This is available at £4.75 from the Councils and Education Press Limited, 10 Queen Anne Street, London W1M 9LD. (See SEN 29.16.3)

9. THE DIPLOMA IN MATHEMATICAL EDUCATION OF THE MATHEMATICAL ASSOCIATION (SEN 34.12)

The following institutions have expressed strong interest in holding courses for the Diploma. The list is correct up to 1 October 1977.

Westminster College, Oxford
Avery Hill College, Eltham
Brighton Polytechnic
Edge Hill College, Ormskirk
Roehampton Institute of H.E.
Christ's College, Liverpool
Shrewsbury Technical College
Rolle College, Exmouth
Bishop Grossteste College, Lincoln
Hull College of H.E.
St. Mark & St. John, Plymouth
Matlock College of Education
Christ Church College, Canterbury
Kingston Polytechnic
Chelmer Institute of H.E.
Ripon and York St. John
Keswick Hall, Norwich
Buckinghamshire College of H.E.
Notre Dame, Liverpool
West London Institute of H.E.
Derby Lonsdale College
Bristol Polytechnic
West Sussex Institute of H.E.
St. Lukes College, Exeter
Thomas Huxley College, Acton
Newcastle Polytechnic
Kesterton College of Technology
Doncaster Metropolitan Institute
New College, Durham
Sunderland Polytechnic
Colchester Institute of H.E.
Ipswich Civic College
Trinity & All Saints, Leeds
Barnsley College of Technology
C.F. Mott College, Prescot
Leeds Polytechnic
Homerton College, Cambridge
Polytechnic of the South Bank
St. Mary's College, Cheltenham

Many of these institutions are likely to begin courses for teachers in September 1978. Prospective students should get in touch with individual colleges.

The Secretary of the Diploma Board is:–

Mr M L Cornelius,
School of Education,
University of Durham,
48 Old Elvet,
Durham DH1 3JH.

10. POST-GRADUATE DIPLOMA IN MATHEMATICAL EDUCATION: Polytechnic of North London (two evenings per week for two years)

A refreshing look at 'new' topics in mathematics, e.g. statistics, computing, history of mathematics, fundamental trends in mathematics learning.

Graduates (not necessarily in mathematics), and teachers with certificate in mathematics as main study, are eligible.

(This diploma is associated with the Post-graduate Diploma in Statistics and Computing, of the Mathematics Dept., PNL).

Further information and application form may be obtained from Celia Hoyles, Course Tutor, Department of Teaching Studies, Polytechnic of North London, Prince of Wales Road, London NW5 3LB.

11. MATHEMATICS IN EDUCATION AND INDUSTRY (see SEN 3.20 and 14.60)

The Mathematics in Education and Industry (MEI) Projects and the Schools and Industry Committee of the Mathematical Association both have their origin in a conference called by the British Petroleum Company Limited in 1961 to study both the shortage of mathematicians, and the kind of mathematical ability required in industry, commerce and government research organisations.

The Schools and Industry Committee has representatives of both education and employers. Initially it was concerned principally with the sponsorship of the MEI Projects, and the foundation of new groups. Since then, while still sponsoring specific MEI projects, it has also given grants to groups of individuals who are concerned with the tasks of bringing industrial applications of mathematics into the classroom, and improving the mathematical preparation of pupils who will enter industry or commerce.

The Committee believes that introducing industrial applications to pupils not only helps towards their preparation for employment but that it also helps generate an interest in mathematics itself. At present (1977) the Schools and Industry Committee receives its funds from the British Petroleum Company, Shell (UK), and IBM (UK) Ltd.

As a result of contact made between practising school masters and industrial mathematicians, together with appropriate members of staff of university departments, members of the North London Schools Branch of the MEI decided that some modifications in the then existing examination syllabuses were desirable. Accordingly, new syllabuses were introduced at the Ordinary Level and Advanced Level. The first Ordinary Level Examination was held in 1965 and the first Advanced Level in 1967. More recently MEI has associated itself with the Contemporary School Mathematics (St Dunstans') Project, and the Ordinary Level Examination, set on a revised syllabus, is now known as the MEI (St Dunstans') Ordinary Level. Information on these syllabuses is available from the Oxford and Cambridge Schools Examination Board (10 Trumpington Street, Cambridge CB2 1QB).

Some of the projects supported by the Committee are described in the next section.

The North London Schools MEI Project

The original project of the MEI was based on a group of schools in London. A leading school master spent a substantial part of 1962 attached to British Petroleum. His objective was to discover the mathematical concepts widely used in industry. He was also concerned with the use made of mathematics by other academic subjects and was interested in topics for which mathematics up to Advanced Level was essential. One result of this attachment and associated contacts was the development of the syllabuses referred to above. (From 71 candidates in 1964 the MEI (St Dunstans') Ordinary Level Examination has grown to be taken by 3724 candidates in 1977). A similar though in many ways more striking growth has taken place in the entries for the Advanced Level Examination sponsored by the MEI – from approximately 250 in 1967 to approximately 2500 in 1977. A tenfold growth in ten years!

This project was also concerned with the introduction of numerical techniques and computing skill into schools; computing facilities were made available to any number of schools with the help of industry and considerable help was given by university and industrial staff. Those involved in this project were convinced of the great benefit to be derived by teachers from industrial visits and a project was consequently established elsewhere with these visits as its prime objective.

The Bristol and Bath MEI Project

In this area of England there is a wide range of industrial undertakings and an active branch of the Mathematical Association as well as an industrial member of the Schools and Industry Committee. This was therefore selected as the area to continue the work described above.

The scheme developed was that a teacher concerned was put in touch with a person with appropriate responsibilities within a firm and then made their own arrangements for dates, types of work and so on. The visits were usually arranged for a week or fortnight during the school holidays. On the whole, teachers went to firms on their own rather than in groups. Teachers were encouraged to write short reports on their visits and there were meetings of all those taking part in the project.

A valuable follow-up of this project was a course run (over three years) by Bath University and instigated by teachers who had been on industrial visits; each week during term informal lectures were given which related the mathematics the teacher had encountered in industry with the modern syllabuses being taught in school.

The Sheffield MEI Project

This project was the result of active cooperation between industrialists and educationalists and covered the local authorities in the Sheffield area of England. The Sheffield Region Centre for Science and Technology was closely in touch and now works with the project. One of its major activities has been an annual one day conference, which large numbers of industrial and school representatives attend. The MEI group devised a written test to meet the need, expressed by industry in 1968, for a process for selecting from school-leavers those capable of becoming craft apprentices although they had no examination qualifications in mathematics. (See also SEN 34.16.12)

The Stockwell MEI Project

It had been suggested that by introducing students at colleges of education to industry they would be better prepared to teach mathematics at an elementary level in school. At Stockwell College of Education in Bromley students have visited local industries and commercial firms since 1973 in order to discover what mathematics is being used; it is hoped that students also develop an appreciation of the advantages of this kind of contact and so wish to pursue similar contacts when they become qualified teachers. The number of students involved in this experiment has been relatively small. An account of the experiment may be found in D A Jones and J G Wilshaw: Mathematics in Education and Industry Project – an experiment in the training of teachers, **Mathematical Education for Teaching,** December 1974 (pages 17–35).

Other projects or groups have been based on other areas of England and Wales but their activities have now ceased.

Conclusions which have been drawn from MEI Projects

a. Teachers who have participated in MEI activities obtain knowledge and experience which lead to enrichment of their teaching.

b. Brief industrial visits concerned with observing the workings of industry have their place but much greater value results from periods of attachment to enable work on a single department to be explored in some depth.

c. Many smaller firms are unaware that their activities make use of mathematics.

d. Good prior preparation is needed so that the visitor and the industrial staff concerned in the visit have clear and precise ideas of the objectives which it is hoped can be achieved from the visit.

e. Little can be achieved unless individuals with the required desire, energy and enthusiasm are encouraged and helped – both in the industrial organisations and in the schools.

f. The life of a particular project is limited, however successful the project may be, and the continuance of the project is endangered when the enthusiasm of its initiators is turned to other schemes or its initiators move from the area.

g. Teachers engaged on projects are reluctant (or are too busy) to write reports and so pass their experience on to others!

h. Difficulties arise because teachers find it hard to get leave of absence in term time and industrial concerns do not welcome visits in their own holiday periods.

(The above information is taken from a paper prepared by the Schools and Industry Committee of the Mathematical Association.)

12. MATHEMATICS TEACHER EDUCATION PROJECT (MTEP) (see SEN 32.11)

A delay has occurred in the publication of the materials developed by this project which were expected late in 1977. It has now been announced that publication can be expected in January 1979. The material will take the form of a tutor's book and a student's resource pack – both in seven sections covering the fields of –

mathematical awareness
children thinking
teaching samples
mathematics and other subjects
resources
topics to be taught to graduates
teaching particular groups of children.

Further information is available from:–

Centre for Studies in Science Education,
Department of Education,
University of Leeds,
LEEDS LS2 9JT.

13. PUBLICATIONS

13.1 **A Laboratory Manual for Schools and Colleges** by J Creedy, published by Heinemann Educational Books, 1977, at £8.75

A useful book for the **general** laboratory technician and science teacher in UK institutions. It will not be very helpful for the school or college laboratory **assistant** in many less well-developed countries. For example, the book deals with tools, apparatus and processes which are certainly not available in Kenyan schools and, indeed, in very few UK schools. The main deficiency of the book is its failure to assist with the day-to-day activities in the science laboratory.

For both chemistry and biology the most useful chapter will be 'Laboratory Solutions' where the preparation of a very comprehensive range of reagents is considered. However, for the chemistry teacher and technician there is little help with construction and maintenance of apparatus (pH meters, balances, electrodes etc), first aid and the setting up of particular types of experiment.

For biology the chapters on Greenhouse Management is good, but it will be of little significance in Tropical Areas. It is a pity that the care and maintenance of microscopes and the sharpening of scalpels is not discussed. For Physics there is a lengthy Electronics section describing the components and construction of many circuits. It appears too advanced for all but the very experienced physics technician. Unfortunately, the book does not look at the maintenance and repair of meters, bridges etc – surely a major task for the physics department in any school or college.

The book emphasises workshop practice and processes at the expense of more specific advice on particular experiments and apparatus. Both teachers and technicians of chemistry and physics would, I feel sure, have appreciated chapters entitled 'Practical Hints on Experiments in Today's Science Courses' and 'Making your own Apparatus'. To keep these chapters within reasonable limits the author should have made more reference to articles in ASE, CCEA/SE and SSSERC journals.

For biology, there should have been consideration of: keeping leaves (particularly in the Tropics), traps, collecting specimens, a biology laboratory garden, making models, bones and preparing skeletons. Again, apparatus and materials for common biology experiments receive scant attention.

The book would make a useful addition to the science department on prep. room collection. It will certainly have to be complemented by manuals concerned with the specific problems of the individual science subjects.

13.2 **Pupils' Attitudes to Science: A Review of Research** – Milton Ormerod with Derek Duckworth, published by NFER Publishing Company, 1977, price £3.50

The mid-sixties saw a thorough inquiry into the flow of students of science and technology into higher education. The resulting Dainton Report (1968) laid particular emphasis on the phenomenon which became known as the swing away from science!

This book sets out the thesis that whilst curriculum reform in science education has made school courses more interesting, it has also made them more difficult so that in spite of a substantial investment in course development, pupils do not seem to like school science any more than they used to. It contains an exhaustive documentation of research conducted mainly but not entirely within the English-speaking world on attitudes to science in secondary schools.

By carefully sifting the evidence of over 500 research projects the authors outline the influence on pupils' liking for science of practical work, discovery learning, co-educational and single-sex schooling and the early age at which interest in science develops. In addition, the effects of the childs' background, his or her concepts of scientists and their work and anxieties about the possible undesirable implications of scientific and technological advance are discussed.

This book will be of value to all involved in science education, whether in schools, colleges, universities or administration, who are concerned about the possible major shortage of scientists and technologists in the next decade.

13.3 **Scottish Integrated Science: New Science Worksheets**. Published by Heinemann Educational Books, 1977, total cost of worksheets, workcards and teachers' guides, £8.85.

The Scottish Integrated Science Scheme is broadly described in **SEN 34.2** (1977). The working material has now been published, consisting of Teachers Guides, New Science Worksheets and Extension C Workguides. Each of these comes in two parts, one book/worksheet file with sections 1–8 and the other with sections 9–15.

The Teachers Guide and the Worksheets come already punched for filing, although they may be left in book form if that is desired.

The Teachers Guide is comprehensive. It begins with a long introduction to the Course which tells the teacher the aims of this type of science education, how to use the material, and also useful practical information as to how to organise the laboratory, assess the pupil and much more.

The Course is split into self-contained sections, each section itself being split into modules which consist of 'core' material, which all pupils do, and ancillary material branching off from it. The ancillary material being divided as: suitable for less able (30% of pupils), average (60% of pupils), and above average (10% of pupils).

In the Teachers Guide the various modules are related to each other by a flow diagram, enabling the teacher to see the interrelationship of the parts of the course immediately. It is quite clear which particular worksheets refer to which module in the course. The ancillary material for the more able pupils is the Extension C Workcards.

Each section in the Teachers Guide also includes section activities, advanced preparation and apparatus needed.

A highly structured course with a great deal of help for the teacher, it also attempts to deal with the problem of mixed ability groups in a constructive manner.

13.4 **Everything, Everywhere, Everyone.** Pupils' book 1 – by Bill Buckie, Robin Sinton, Les Young, published by Oxford University Press, 1976, at £1.95.

A modern course in integrated science for 11 to 14 year olds, following the Scottish syllabus (curriculum paper 7).

The book is divided into 29 units of six pages each; each unit covers one weeks work of four to six periods. These units in turn are divided into an initial three pages of practical activities, followed by one page of text summarising basic ideas and concluding with a couple of pages of background enrichment material.

The work is written in short simple sentences easily understood and interesting to the child. A not unsuccessful attempt has been made to integrate Physics, Chemistry and Biology, including an unusual experiment to combine Physics and Chemistry – making a cup of coffee!

13.5 **Certificate Physical Science Book I** – by A G Mee and A C E Jarvis, published by Heinemann Educational Books, 1977, at £2.20.

Book I: Theories and Models.

The first of two books covering the Physical Science O-level syllabus, designed to be used for the two years leading up to the exams.

The approach is spiral rather than linear, ie: topics are not covered entirely at one time but are returned to, with suitable revision, a couple of times. Well set out, it is designed for a teacher to use much in the traditional style.

The book is written in topic – chapters, the first of which 'The Work and Aim of Scientists' is unusual and interesting. Each chapter is divided into short sections, well interspersed with experiments, and with questions at the end along with a summary of the chapter. These are optional background readings presumably designed for the bright child to follow while the rest catch up.

13.6 **The Shapes of Organic Molecules**. By N G Clark, Modern Chemistry Background Reader, published by John Murray, 1977, at £1.85.

The purpose of this small book is to persuade the student of organic chemistry to think in 3 dimensions about even

the simplest molecule or reaction. So often in introductory treatments the special aspects are reserved as a separate topic discussed later in the course. Consequently, the title has avoided the term stereo chemistry which for many implies such narrow concepts as lactic and maleic acids, asymmetric carbon atoms and optical activity.

The text falls roughly in to 3 portions. The first deals with the molecular architecture of simple compounds and is mainly 3 dimensional geometry. The chemical and biochemical implications of this geometry are discussed and illustrated in the second section, while the third affords a brief glimpse at the fascinating architecture of some of the more complex molecules of biological importance. Throughout the text IUPAC organic nomenclature has been used. However, in many cases of historical or traditional usage, it is not systematic: nevertheless, it employs the preferred IUPAC aims. Where the latter are first encountered, they are accompanied by their systematic equivalence.

The book is written in a very readable style, and is profusely illustrated with line drawings and tables of physical properties etc and the general style of writing treats a difficult topic in a commendable fashion which would be suitable for a student of organic chemistry meeting this interest for the first time, either as an undergraduate, or as a student in a National Certificate or Advanced level course.

13.7 **Evaluating the Suitability of 'Real Models' for Teaching Chemical Structure and Properties** – Dr M B Ormerod, Senior Lecturer in Chemistry Method, Department of Education, Brunel University, Uxbridge, 1977.

Copies available from the author.

A short type-written paper discussing the place of 3-dimensional models in chemistry teaching at all levels. It criticises the common misuses of models, eg: polystyrene balls illustrating metallic structure do not show conduction properties and lead to confusion with ionic structures. A list is made of the fundamental components of a chemistry model kit and these are considered individually.

Also included is an appendix on the use of film strips/slide sets and taped commentaries.

13.8 **Introduction to Genetics** – by D G MacKean, third edition, published by John Murray, 1977, at £1.40.

This latest edition is intended for students who are following, or have just completed British O-level courses. Selections of the material would also be suitable for students of human biology, or possibly anatomy and physiology courses.

This particular account of genetics is based on the modern cytological approach and is extended to an understanding of the relationship between heritable variation and biological change. A great deal of content is in fact devoted to explaining evolution and natural selection in these terms.

The third edition capitalises on previous versions and contains new material describing DNA replication and transcription and the terms 'backcrossing' and 'continuous and discontinuous variation' have been introduced. The material which was added to the second edition about the inter-relationship between genetics and natural selection is also present here.

The book is printed in the same large format as other MacKean writings published by John Murray and the high standard of illustration prevails throughout. The back-cover flap also contains a short but useful glossary of genetic terms.

13.9 **The Locust as a Typical Insect** – by W M Clarke and M M Richards, published by John Murray, 1977, at £1.50.

The contents of this interesting book are basic to an O-level study which would normally occupy about 10 weeks of a typical full-time school biology course, in an overseas setting.

The book is far from a straightforward dissection manual. For example, the relationship between form and function is constantly emphasised with descriptions of such basic concepts as the action of antagonistic muscles, gaseous diffusion and response to the environment. The content of the book is also extended as far as a discussion of the impact of locust life on man's activities and the preventive measures which he takes to combat them.

The book also contains short paragraphs of extension work which are intended for sixth form students. These accounts are based on simple and inexpensive apparatus and there is a degree of flexibility in this advanced work in that the practical instructions are of a general nature and stimulate a degree of independent thought in the more mature student.

There is a particularly interesting experimental account of the breathing movements in locust and most biology teachers will find a rewarding amount of new practical experiments in this well illustrated book.

13.10 **Animals of the World Series. The Elephant.** Words by John Anthony, pictures by Nemo, a Ravenwill disco book from 1 Devonshire Street, London W1. Cost of book 40p, disco book 99p, cassette £3.50 for eight titles.

This short 11 page story book about elephants is lavishly illustrated with lifelike colour photographs. It is one of a

series of similar books edited by John Anthony, a former presenter of the BBC's Roundabout programme and it bears the stamp of someone who can strike a happy balance between entertaining children and providing them with interesting information.

The book is accompanied by a disco book which is a plastic covered cardboard folder incorporating the tracks of two recordings at $33^1/_3$ RPM in the covers. These tracks when played on a normal reproduction equipment reproduce an account of the story material in the spoken form. An elephant's trumpet call indicates when to turn over the page of the story book, so that both recording and storybook can be used together, with obvious benefits to the reading experiences of children.

The excellent illustration and sound effects combine to provide a realistic projection of information about the habits of Asian and African elephants, together with some relevant general information which is presented in a form which will have strong appeal for young listeners in the 6 to 10 years age range, and which is comparatively inexpensive.

13.11 **Practice Tests for CPE Maths** – by Sushila Bakhda, published by Oxford University Press, Eastern Africa, for Kshs 10.

One of the most common ways of preparing candidates for a public examination is to give them practice on papers set in that examination in previous years. When a new syllabus is introduced, no relevant papers exist, and there is a temporary though ready market for a booklet of appropriate practice tests.

This book fulfils this need in mathematics for candidates in Kenya's Certificate of Primary Examination (CPE), in which a new syllabus was introduced in 1977, based on the Kenya Primary Mathematics (KPM) series of texts.

The booklet contains five practice papers, all in the multiple-choice format of the examination itself. The author is also one of the authors of the KPM texts. The mathematical coverage and the standard of difficulty of the questions are appropriate to the booklet's purpose. Despite a claim that the papers were pre-tested, however, occasional infelicities of language remain.

OVERSEAS AND INTERNATIONAL ACTIVITIES

14. SCIENCE EDUCATION PROJECT, SOUTH AFRICA

The Science Education Project was launched during 1976. It does not aim initially at producing a new syllabus or new text books. In fact, the Project will be based on a number of existing texts. However, the Project does aim at producing a coherent 'science teaching package'. It is the first curriculum development project to be initiated in South Africa – in any school subject.

The Package

The ingredients of the package are listed below:

A text book
Demonstration apparatus based on the text book
Student kit
Worksheets for the kit
Teacher's guide
Orientation course

(a) **A Text Book**

A number of science educators were approached and asked to evaluate all the existing approved text books. Criteria were drawn up to expedite and standardise the process. As a result of this evaluation, the text books considered by the evaluators to be the best, have been identified.

(b) **Demonstration Apparatus**

Although it may seem an elementary point, in the past the apparatus supplied to schools has not always corresponded to the apparatus depicted in the text book in use at that school. The Project aims at making the match between the two.

(c) **Student Kit**

A kit has been designed for use by groups of pupils. It is one of the main areas of innovation attempted by the Project. The idea of kits of this nature is not new. (For example, chemistry kits have been developed for use in Kenyan schools.) However, the S.E.P. kit combines both physics and chemistry. The baseboard on which the chemistry activities are performed can also be used as an electric circuit board, a stand for a simple beam balance and a stand for a manometer.

(d) **Worksheets**

Worksheets are being produced to help pupils use the above kits. Each worksheet starts off by stating a problem to be solved. The worksheets attempt to emphasize the use of diagrams, rather than the written word, in the giving of instructions.

(e) **Teacher's Guide**

A teacher's guide is being prepared for each of the three text book series on which the Project is being based. (School A may use the Project materials based on book X, whereas school B uses a different set of materials based on book Y). Amongst other things, the teacher's guide seeks to integrate the use of the kits into the framework provided by each text book.

(f) **Orientation Course**

During the course of the Project, teacher education materials will be developed which could be used at orientation courses for teachers who will be using the S.E.P. package for the first time.

Aims and Objectives

From the above, it should be clear that one of the aims of the Science Education Project is to evolve a method of equipping schools for science education on a systematic and economic basis. Economic, in this sense, is defined as good return for money.

The Project also aims at encouraging a shift in teaching strategies, away from rote learning towards an inquiry based approach. One way of achieving this will be to place emphasis on scientific processes as well as on content.

Some of the objectives which have been identified this far are given below.

Teacher:

Be aware of specific scientific processes i.e.

- Observing
- Measuring
- Classifying
- Predicting
- Hypothesising
- Verifying
- Model making

(a) Be able to identify which processes are applicable to a particular activity.

(b) Be able to establish a question or problem on which to base a lesson.

Be able to structure a lesson as an inquiry.

Be able to relate the science in the classroom to everyday life, where this is possible.

Children:

Become aware of the nature of science:

(a) Ability to use scientific processes.

(b) Understand the relationship between cause and effect in the natural sciences.

(c) Be aware of the kind of activities in which a scientist engages.

(d) Ask the type of question that leads to an inquiry.

Handle apparatus with confidence.

Perform the activities satisfactorily.

History of Project to Date

The Project was launched in 1976 using a grant from the Anglo-American Corporation, and based at the Univeristy of Fort Hare.

During the later part of 1976, two surveys were carried out. The one was in the form of a questionnaire sent to all secondary schools in the Ciskei. The main purpose of this questionnaire was to isolate

(a) the facilities at schools with respect to practical work.

(b) difficulties experienced by teachers in performing practical work.

(c) the qualifications of science teachers.

In addition to this a number of schools were visited. The main purpose of these visits was to establish:

(a) what apparatus existed in the particular school.

(b) what practical work was performed at that school during 1976.

(c) how frequently various items of apparatus were used during 1976.

The Project was officially launched at a Conference in February 1977. Various experts were invited to comment on the Project and to make suggestions on how best to achieve the aims and objectives. Also invited to sessions of the conference were the teachers who will be involved in the initial trials and education administrators who would be in the position to implement the final materials.,

Present Activities

The main task facing the Project for the remaining part of 1977 is the production of the worksheets and teacher's guides, and the development of the student kit. These items will need to be ready before the beginning of 1978, when the initial trials are scheduled to begin.

Further information on the Project's activities can be obtained from its Director:

Mr John Rogan,
Science Education Project,
Faculty of Education,
University of Fort Hare
PO Box 314,
Alice 5700

15. THE REGIONAL CENTRE FOR EDUCATION IN SCIENCE AND MATHEMATICS (RECSAM)

(see SEN 6, 14.11, 21.16, 25 x and 18.43)

The Centre was established in May 1967 in Penang by the South East Asian Ministers of Education Organisation. The purpose of the Centre is to help improve the teaching of science and mathematics in member countries in order to lay a firm foundation for meeting the scientific and technical manpower needs of South East Asian countries in the future.

To achieve the purpose for which it was established RECSAM undertakes the following activities:

a. Training programmes for key educators in modern methods of teaching science and mathematics.

b. Development of action-research techniques.

c. Critical study of selected pilot project materials.

d. Development of specific studies and instructional materials to be carried out as a project.

e. Critical examination of research on curriculum materials and methodology.

f. Development of simple techniques in apparatus-making using low-cost materials.

g. Organisation and conduct of professional seminars and workshops for educators in the region.

h. Gathering of information and acting as a clearing house for science and mathematics education in the region.

i. Consultation and special services for member countries on request.

k. Promotion of indigenous efforts in curriculum development.

From its inception RECSAM has expanded and in 1977 has taken possession of a new complex of buildings which have extended its capacity to accommodate more trainees and conference participants. The new complex of buildings provides, in addition to the existing hostel accommodation and recreational facilities, a complex housing two laboratory blocks, a library/information building, a conference hall, an administrative/teaching block, a prototype apparatus production unit and an educational television studio. These facilities have come into use during the course of 1977.

RECSAM is sponsoring two major regional pilot projects:–

SEASAME – The South East Asia Science and Mathematics Experiment which aims to encourage indigenous efforts in curriculum development in primary science and mathematics in the region by providing training in a 'learning-by-doing' format at both the regional and national levels. Prototype teaching modules are developed and produced by involving participants attending several related courses at RECSAM. These materials are then tried out in the participants' own countries and subjected to evaluation.

The Science and Mathematics Concept Learning of South East Asian Children is concerned to investigate how children learn basic science and mathematics concepts and ultimately with developing teaching modules from the results. During 1977 a decision to introduce group testing methods into the design of the project has been taken. The research is carried out by the staff of RECSAM and people in the member-countries working together, data obtained from project experiments being sent to RECSAM for analysis and interpretation.

16. THE SCIENCE CENTRE, MINISTRY OF EDUCATION, AFGHANISTAN

The activities of this Centre are financed from the Government's budget and by large scale financial allocations from UNESCO. The Centre has in fact carried out a variety of activities during the past 3 years and these fall under 6 main headings.

a. Assistance is given to science and mathematics teachers in the form of refresher courses and seminars, and in fact 5 training sessions for teachers from the provinces were held.

b. Assessment and co-operation in the identification of new teaching methods to improve science and mathematics teaching.

c. Revising more than 50% of the science and mathematics books in use and compiling laboratory guides, teachers' guides and auxiliary teaching material.

d. The preparation and repair of the science teaching equipment. The Centre has participated in the distribution of 54 kits of laboratory equipment for schools and a further 400 kits will be provided by the end of the year.

e. On the job training is provided for science supervisors and mathematics personnel in the rural areas according to their needs and requirements.

f. There is a research interest which forms the basis of science and mathematics projects and there is a research element in the holding of training seminars for laboratory teachers in the use of laboratory equipment.

Within the Centre there are 7 departments. These are organised in 3 main branches, science, technology and vocational. The science and mathematics department, for example, besides carrying out basic scientific work also assists in the preparation of science kits and with book writing. The research department collects data for the development and improvement of science curricula and the publication department shoulders all responsibility for the publication of new books, the revision of existing books, and compiling training programmes and special publications for seminars and refresher courses. The Centre's workshops also function as a separate department handling the design and preparation of science kits.

For the future, the Centre intends greater activity assuming continuing UNESCO support, providing more scholarships for the training of personnel, the continuing preparation of science kits, of programmes for audio-visual training and the expansion of the present workshops. A new activity will be the establishment and development of publications and broadcasting departments which will be concerned mainly with secondary schools and it is hoped to enter into the construction of a new building to house the activities of the Science Centre. The writings of teachers' guides and text-books are closely related to the stipulations of the Government's educational reforms in Afghanistan.

A final problem is concerned with the importation of publication materials and the difficulties experienced with obtaining the printing facilities which are needed for the expansion of the publications department.

17. IN-PLANT EDUCATION, SRI LANKA

In-Plant Education projects are essentially work experiences for pupils in factories (and farms in the future). The pupils attend for two hours a week. These experiences are designed to fit in with the new idea of pre-vocational training by which the school education is made more relevant to the economy of the country.

Gathering Experience in Work Places – A Handbook describes the concept and a pilot study already carried out (1976). It is published by the Curriculum Development Centre, 255 Bauddhaloka Mawatha, Colombo 7.

18. SCIENCE EDUCATION NEWS FROM JAMAICA

Curriculum Development

This aspect of the educational scene has occupied the energy and efforts of local staff for a period of a year. Units have been prepared for grades 10 to 11 of the continuing education curriculum of the Ministry of Education and there has been some preparations for evaluation and assessment. Another interest involves the development of a core curriculum for integrated science which will meet the needs of the large group of Jamaican students for whom the CXC double subject O-level integrated science curriculum is not intended.

Caribbean Examinations Council

Plans have been formulated which build on the formulation of statements about skills and objectives for the initiation of a series of training seminars for pilot teachers in the first units submitted for consideration. These units are entitled Atomic structure and Bonding and will form the basis of a training programme initiated by the Integrated Science Committee.

Primary Science Resource Centre

The Ministry of Education has with the assistance of the OAS set up 3 sites which it is hoped will develop into fully fledged primary science resource centres. The centre has maintained close contact with the centre at Knox Junior School which is supervised by the Knox Community College.

19. PRODUCTION TEACHERS VACATION COURSE, GUYANA 1977

This course was held at the Industrial Arts Centre, Georgetown, Guyana, from 8 to 26 August and was organised by seven local tutors with two British visiting tutors (Mr Gron Edwards, Primary Science Warden, Centre for Primary Science, South London Science Centre, and Alexander Pirie, Science Adviser, Tyneside Region, Scotland). There were 35 local teachers as participants and the objective of this training was to reduce the possibility of the normal delays and the high costs traditionally associated with the purchase of overseas equipment and to lend support to the practical emphasis of the curriculum renewal programme which is now current in Guyana.

Evaluation was carried out by group discussion producing long-term recommendations, trial of an item of equipment with the test group of schoolchildren, and the preparation of a questionnaire which was completed by the participants on the course.

Follow-up Activity

a. The Report will be circulated to all head teachers.

b. Head teachers will be asked to send Representatives to a meeting to discuss this vacation course and to attend regional seminars to discuss follow-up and secure their interest and personal support.

c. A working party to be set-up to consider packaging, transport and storage of equipment when it becomes available in schools.

d. Teachers are invited to produce prototypes as used in the class and to submit them for evaluation.

e. A centre is to be set up in Georgetown to produce prototype kits that could then be considered for mass production.

f. Co-operation between teachers in schools and those in industrial arts centres is encouraged. Nine regional centres are named as possible production units.

g. An invitation was issued on the last day for teachers to attend a continuation project at a named school, on specified Saturday mornings, over 11 weeks, which begin in September 1977.

20. THE MALAYSIAN ASSOCIATION FOR SCIENCE AND MATHEMATICS EDUCATION

The Association was formerly registered on 17 August 1976 and has an approved membership of 47. The officers on the Association for 1976 are: Honorary Secretary En Wahidullal Khan, Assistant Secretary Mr Leong Wing Fatt, Editor E Prabakhar. The objects of the Association are: (a) to promote the advancement of science and mathematics education in Malaysia, (b) to foster professional interest in science and mathematics education, (c) to provide a medium through which those involved in science and mathematics education may express their views, (d) to afford a means of communication among persons interested in science and mathematics education through academic, social and cultural activities, (e) to publicize journals, newsletters and other educational publications of scientific and mathematical interest, (f) to affiliate with the prior approval of the Minister of Home Affairs with organisations sponsored or assisted by UNESCO or other United Nations agencies.

The British Council has already provided funds to enable the production of the first issue of the Association's journal and future activities also include the preparation of the Association's emblem/symbol and to secure affiliation with the International Council of Association for Science Education.

21. SCIENCE IN THE YORUBA LANGUAGE

In a journal of the Science Teachers Association of Nigeria Vol 15 No 1 dated December 1976, Dr R O Alaby of University College Ilorin Nigeria highlights some of the problems of teaching science in the Yoruba language.

He begins by pointing out the advantages of teaching science in the child's mother tongue such as overcoming the limited knowledge of a foreign scientific vocabulary, and bringing closer together children, scientific examples and concepts derived from them. He also draws attention to developing a scientific store of vocabulary in the mother tongue and helping adults who are not literate in English to understand and appreciate science.

He gives some interesting examples of the use of Yoruba in science teaching during the six year project at Ife and suggests for example that in using the natural environment, terms such as water and sunlight, do have a Yoruba equivalent already. However, when new concepts are introduced such as magnets and magnetism, then the Yoruba language presents difficulties.

In the case of colours the Yoruba language has some interesting parallels, there are already words for red, white, black and indigo (which is used in dyeing) and in some situations foreign words have already been localised for example yellow and blue whose equivalents are yelo and buluu Nevertheless, some foreign words have no equivalent such as violet, grey and purple and to complicate the situation further a particular Yoruba word such as 'pupa' may stand for several different colours such as pink, orange and red.

22. JOINT ICMI/CTS/UNESCO PROGRAMME ON COOPERATION BETWEEN SCIENCE TEACHERS AND MATHEMATICS TEACHERS (SEN 34.26)

Further information about this important international programme is now available.

A joint steering committee is guiding the work, which will culminate in a conference in Bielefeld, West Germany in September 1978.

The aims are:–

a. A number of small practical booklets would be produced for use by practising maths and/or science teachers. As far as possible they would contain practical examples and case studies. It was hoped that these would have an international appeal and would be read by a mass audience.

Each booklet would deal with a specific topic. Topics would depend on the materials submitted or collected but suggestions are: numeracy, liaison between maths/science departments, relationship between the curricula for maths and for physics, uses of maths in geography, biology etc, implications for teachers' education.

b. The programme would primarily concern school education (11–19) relating maths (including statistics) to physics, chemistry, biology, geography and any other science extensively taught at school level under the general titles: earth sciences, environmental sciences (probably including some geology, astronomy, architecture, etc).

c. It is hoped that relevant materials, reports and names of useful contacts will be sent to: The Editor, Alan Rogerson, Research Director, SMP, Westfield College, Kidderpore Avenue, Hampstead, London NW3 7ST.

The provisional timetable:

August–December	1977:	Collection, distillation of materials, reports etc.
January	1978:	Meeting to review, discuss, suggested booklets prepared by the Editor.
Feburary–Sept	1978:	Finalisation and circulation of materials for Bielefeld Conference.

Among the topics to be covered in preparatory reports and in the final publication are:–

a. **'Mathematics in the science lesson'**: much can be done to help science teachers, when they are using mathematics, to express themselves in such a way that present-day pupils who are taking present-day mathematics courses can understand what is being said as well as possible. In some countries, **booklets** to help in this have been prepared; are they useful, or is any other particular approach more useful? Conversely, what has been done or should be done to give mathematics teachers information helping them, if possible, to relate the timing of particular mathematical material to the needs of the science lesson?

b. **'Philosophical background and educational theory'**: what are the educational goals to be cooperatively sought (attitudes regarding mathematics in relation to the sciences, skills in 'mathematical modelling' of scientific problems, etc) and what are the relative merits of different methods (various types of separate, but coordinated, activity in science teaching and mathematics teaching; or different kinds of project work organised cooperatively by science teachers and mathematics teachers)?

c. **'Implications for teacher education'**: is there a need to **prepare** secondary-school teachers in the skills needed to cooperate with teachers of other subjects; for example, to prepare mathematics teachers to be able to seek out from science teachers material suitable for use as concrete illustrations of mathematical concepts; or to be able to make known to science teachers matters of notation and methodology used in current mathematical courses so as to avoid confusion in the science classroom?

d. **'Case studies by geographical and subject areas'**: it may be important to distinguish problems arising in a highly-mathematicized science like physics from those arising in a science like biology whose mathematical content has in the past been less although it is now rapidly growing; and, similarly, with problems in different countries (countries with a traditionally abstract approach to mathematical education, or countries whose approach has traditionally been more concrete, or developing countries with a strong emphasis on practical utility in educational curricula). For these reasons, we ask: what has been done or is currently planned in cooperation between mathematics and particular sciences in particular countries?

e. **'Guidelines for cooperation including practical examples'**: from the information on educational aims, or experience from the past, and on future plans, what can we conclude about particular approaches that can be strongly recommended in particular situations?

The Steering Committee also noted a topic that it prefers not to see included. There is no intention to discuss ideas for fully **integrated** mathematics and science teaching at secondary level (if, indeed, such a comprehensive degree of integration is possible). It is by design that the Programme's title includes the word 'Cooperation' but does **not** mention 'integration'. The Steering Committee does not wish the Programme to be deflected into any massive discussion of detail such as would be needed in relation to schemes (with, in most cases, a rather low chance of coming to fruition) for integrated curricula. By contrast, techniques for cooperation between teachers **can** be discussed fruitfully, because such techniques are capable of being introduced individually in particular educational systems, or sometimes even in particular schools, as and when they are locally agreed.

23. AUDIO VISUAL MATERIAL FROM OVERSEAS CURRICULUM DEVELOPMENT PROJECTS (SEN 30.14.2; 31.18)

A further film strip in the Southern African series is now available.

The Mathematics Workcards Project: The Strip System:

This is a study of the Mathematics Workcard Project in use in one of the pilot schools in Swaziland. The school has developed a tightly-controlled system of classroom organisation of the cards. This system has been recommended for adoption by other schools involved in the Project. Thirty-three frames.

Like the others in the Sries, this filmstrip/tape is available for loan, or for purchase at £3.00, from the Schools and Further Education Department, The British Council, London (through Representatives overseas).

24. SOUTH PACIFIC MATHEMATICS AND LOGIC COMPETITION (SEN 33.18)

A report on this competition has now been issued, in the form of a special supplement to Forum, the mathematics education journal in the South Pacific region, produced at the University of the South Pacific. Enquiries may be made to Mr Peter Sanders, School of Education, University of the South Pacific, PO Box 1168, Suva, Fiji, or Mr Colin Meek, Mathematics Education Centre, University of Technology, PO Box 793, Lae, Papua New Guinea.

25. THIRD INTERNATIONAL CONGRESS ON MATHEMATICAL EDUCATION (SEN 31.21, 33.24)

The Mathematical Instruction Sub-Committee of the British National Committee for Mathematics assisted with the preparation of material from the United Kingdom for discussion under the 13 Congress themes. During the

preparation of this material an agreement was made with the Schools and Industry Committee of the Mathematical Association to prepare an outline review of some topics which were thought to be suitable for further discussions by teachers of mathematics in both primary and secondary schools. This report is now available. It is in three sections:

a. A general commentary on the congress scene

b. A commentary on the teacher training theme

c. A commentary on the research theme.

Copies of this short informal report are available, free of charge, from the Royal Society, 6 Carlton House Terrace, London SW1.

26. ICMI SYMPOSIUM ON THE EDUCATION OF MATHEMATICS TEACHERS (PRE- AND IN-SERVICE): WHAT KNOWLEDGE, EXPERIENCE AND UNDERSTANDING OF MATHEMATICS SHOULD A MATHEMATICS TEACHER HAVE? To be held at the International Congress of Mathematicians, Helsinki, Finland, August 1978.

Many mathematicians are professionally involved in the pre- and in-service education of mathematics teachers. This involvement includes preparation and teaching of courses, evaluation of students and programmes, planning and holding of seminars, work on committees and in conferences related to education of mathematics teachers.

There is universal agreement that the teacher of mathematics should have mathematical competence. In particular he should have adequate background-knowledge and experience with respect to the mathematics taught at school. This implies that specific parts of applied mathematics and problem-solving activities should be indispensable components of the educational programme in addition to basic instruction in pure mathematics.

It is expected that through his education the mathematics teacher has developed the ability to analyse elementary mathematics from an advanced point of view and has gained the flexibility necessary for representing mathematics at various levels and by a variety of approaches. It is a matter of debate whether special courses are needed to further this expected competence and how such courses should be related to methods courses and other training components in the area of pedagogy and psychology of mathematics teaching and learning.

Also there is an increasing consensus that the teacher of mathematics should have a balanced view of philosophical problems related to mathematics, and of the role of mathematics in culture and society. Curriculum decision and even teaching methods are highly influenced by preoccupations and attitudes linked to these themes, and corresponding misconceptions on the part of teachers are often unintended side effects of the standard mathematical training. This calls for an integration of foundational, historical and sociological aspects of mathematics into the educational programme.

It is an important task for all those who are involved in the mathematical education of mathematics teachers to clarify – for the various teaching levels – what knowledge, experience and understanding of mathematics a mathematics teacher should have. An International Congress of Mathematicians brings together experts from all countries who are most competent to discuss this problem. This is why the International Commission on Mathematical Instruction, a body established by the International Mathematical Union, has chosen the Mathematical Education of Mathematics Teachers as the theme of a symposium during the next ICM to be held at Helsinki, August 1978. An International Programme Committee is being established chaired by the two Vice-Presidents of ICMI, Professor Christiansen and Professor Steiner. Anyone interested in participating in the Symposium is kindly asked to contact either of the co-chairmen, who will also appreciate receiving suggestions regarding the programme of the Symposium.

Professor Bent Christiansen
Department of Mathematics
Royal Danish School
of Educational Studies
Emdrupvej 101
DK 2400 Copenhagen NV
DENMARK

Professor Dr H G Steiner
Institut für Didaktik der Mathematik
Universität Bielefeld
Postfach 86400
D 4800, Bielefeld 1
FEDERAL REPUBLIC OF GERMANY

27. THE 20th INTERNATIONAL MATHEMATICAL OLYMPIAD (SEN 34.27)

The 20th International Mathematical Olympiad will take place in Romania. Exact dates are not yet known, but it will probably be in July 1978.

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